Dissertation on

A CLINICAL STUDY ON CORRELATION OF BLOOD VITAMIN C LEVEL WITH CATARACT IN MIDDLE AGED PEOPLE

Submitted in partial fulfillment of requirements of

M.S. OPHTHALMOLOGY

BRANCH – III

REGIONAL INSTITUTE OF OPHTHALMOLOGY

MADRAS MEDICAL COLLEGE

CHENNAI – 600 003

THE TAMILNADU, DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI

APRIL 2013

CERTIFICATE

This is to certify that this dissertation entitled **" A CLINICAL STUDY ON CORRELATION OF BLOOD VITAMIN C LEVEL WITH CATARACT IN MIDDLE AGED PEOPLE "** is a bonafide record of the research work done by **Dr. K.RAJASEKARAN.,** Post graduate in Regional Institute of Ophthalmology, Madras Medical College and Government General Hospital, Chennai-03, in partial fulfillment of the regulations laid down by **The Tamil Nadu Dr. M. G. R. Medical University** for the award of M.S. Ophthalmology Branch III, under my guidance and supervision during the academic years 2011-2013.

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ACKNOWLEDGEMENT

I wish to express my sincere thanks to **Prof. DR.V.KANAGASABAI M.D,** Dean, Madras Medical College, Chennai for permitting me to conduct this study at Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Chennai.

I have great pleasure in expressing my sincere thanks to **Prof. DR. K.MARAGATHAM M.S., D.O.,** Director and Superintendent (I/C), Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Chennai for her valuable guidance and advice in preparing this dissertation.

I am extremely grateful to my Chief **Prof. Dr. WAHEEDA NAZIR M.S., D.O,** Chief of Cornea Services, Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Chennai for her constant encouragement and valuable support in conducting this study.

With profound gratitude, I thank **Prof. DR. K. VASANTHA, MS, FRSC (EDIN),** Former Director and Superintendent, Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Chennai who was also my mentor for her valuable guidance throughout my postgraduate course.

I convey my heartfelt thanks to Chief Prof**. Dr. M. ANANDA BABU M.S, D.O,** Cornea Services, Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Chennai for his constant support and valuable guidance throughout my course.

I am very grateful to my unit Assistant Professors **Dr. K. MOHAN M.S, D.O, Dr .M. PERIYANAGI M.S, Dr. K. S. T. LATHA M.S,** and **Dr. M. S. GOKILA. M.S, D.O,** for their encouragement and valuable suggestions that made this study possible.

I am thankful to Department of Biochemistry, **Sankara Nethralaya**, Chennai for estimating Blood Vitamin C levels in this study.

I wish to thank all my Professors, Assistant Professors, my colleagues and friends for their timely help, advice and support in making this study possible.

I am greatly indebted to all my patients for their sincere cooperation in this study.

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled "**" A CLINICAL STUDY ON CORRELATION OF BLOOD VITAMIN C LEVEL WITH CATARACT IN MIDDLE AGED PEOPLE"** is a bonafide and genuine research work carried out by me under the guidance of **Prof. Dr. WAHEEDA NAZIR M.S., D.O.**

DATE :

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INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

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CERTIFICATE OF APPROVAL

To
Dr.K.Rajasekaran
PG in M.S.Ophthalmology
Madras Medical College,Chennai -3

Dear Dr.K.Rajasekaran,

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled " A clinical study on correlation of blood vitamin C level with cataract in middle aged people" No.28112012.

The following members of Ethics Committee were present in the meeting held on 01.11.2012 conducted at Madras Medical College, Chennai -3.

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6. Thiru. S. Govindsamy. BA, BL -- Lawyer

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

R Nandini 19/11/12
Member Secretary, Ethics Committee


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Author	Rajasekaran K 22111808 M S OPHTHAL
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Submission time	29-Dec-2012 05:05PM
Total words	8767

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1 Dissertation on A CLINICAL STUDY ON CORRELATION OF BLOOD VITAMIN C LEVEL WITH CATARACT IN MIDDLE AGED PEOPLE Submitted in partial fulfillment of requirements of M.S. OPHTHALMOLOGY BRANCH – III REGIONAL INSTITUTE OF OPHTHALMOLOGY MADRAS MEDICAL COLLEGE CHENNAI – 600 003 THE TAMILNADU, DR. M.G.R. MEDICAL UNIVERSITY CHENNAI APRIL 2013 2 INTRODUCTION Cataract is a disease of senility but can occur in younger people due to other secondary causes. Global burden of blindness with cataract is increasing even though innovative ways of providing quality surgical treatment for cataract has been developed. Patients in middle aged group between 30-50 years who presented to our hospital with cataract...

CONTENTS

INTRODUCTION

Cataract is a disease of senility but can occur in younger people due to other secondary causes. Global burden of blindness with cataract is increasing even though innovative ways of providing quality surgical treatment for cataract has been developed. Patients in middle aged group between 30-50 years who presented to our hospital with cataract without any secondary cause were subjected to detailed clinical history, ocular examination, general examination and Blood Vitamin C level estimation done by Spectrophotometer method.

Vitamin C is the most important antioxidant Vitamin in lens and other ocular tissues. The highly toxic reactive oxygen species that are formed by photochemical reaction of oxygen in the presence of electron donor are converted to less toxic hydrogen peroxide via ascorbic acid reduction.

Studies reveal that there is an inverse association of Vitamin C level with cataract in older people. Of the other antioxidants Glutathione, Lutein, Zeaxanthin, Beta-carotene and Vitamin E, Vitamin C has stronger inverse association in the development of cataract. In our population the mean plasma level of Vitamin C is lower when compared to western countries. So estimation of Blood Vitamin C level and other risk factors in the

development of cataract in the middle aged people is done to find any association.

Detailed clinical history including personal history – diet, tobacco use, alcohol intake, occupation & outdoor exposure, status of living, education status and family history of cataract is evaluated. General examination with anthropometry measurement- height, weight, body mass index and Blood Vitamin C level estimation through Spectrophotometer method is done.

EMBRYOLOGY OF LENS

Developed from the surface ectoderm at 4th week of embryonic life. There are four stages in lens development-lens placode or plate, lens pit or recess, lens pouch or sac and lens vesicle. Around 27th day, lens placode is formed from the thickened ectodermal cells. A groove appears in this layer called lens pit and this groove closes to form the lens pouch which is converted into vesicle. Around 33rdday, the lens vesicle formed along with its surrounding lamina gets detached from the surface ectoderm to sink into optic cup.

During the formation of lens vesicle, cells are arranged in such a way that the basement membrane of anteriorly situated cells face anteriorly and the posterior epithelial cells grow forwards towards the lens vesicle cavity. The cells of the anterior layer of the lens vesicle continue to form lens fibres throughout life. These fibres stop short at various intervals giving rise to sutures.

ANATOMY OF LENS

It is a transparent crystalline biconvex structure situated in the patellar fossa held in position by the zonular fibres laterally, iris anteriorly and the anterior vitreous posteriorly. It is connected to the anterior vitreous in a circular area by means of WEIGERT'S ligament. The space inside the circle between lens and hyaloid vitreous face is called BERGER'S space.

Anterior surface - Less convex than posterior.

Radius of curvature: 10 mm

Posterior surface - Radius of curvature- 6 mm.

Centre of these two surfaces form the anterior and posterior poles.

Equator - Two surfaces meet at the equator.

The equatorial diameter –at birth is 6.5 mm, increases to 9-10 mm in 2^{nd} decade & almost remains constant.

Thickness-

Antero Posterior diameter at birth is 3.5 mm and increases upto 5 mm in old age. Thickness increases by 0.02mm every year.

Weight -135 mg in 1^{st} decade, 255 mg in 4^{th}-5^{th} decade.

Refractive index - 1.39 (nucleus-1.42, cortex-1.38).

Refractive power is about 20 dioptre.

Accommodative Power - At birth - 14 to 16 D ,

25 years - 7 to 8 D ,

50 years - 1 to 2 D

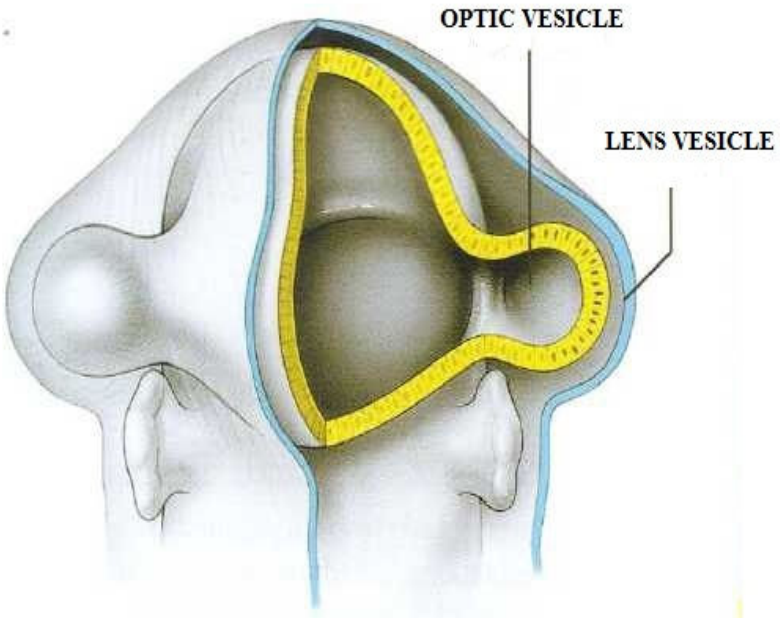


Fig.1 OPTIC VESICLE FORMATION

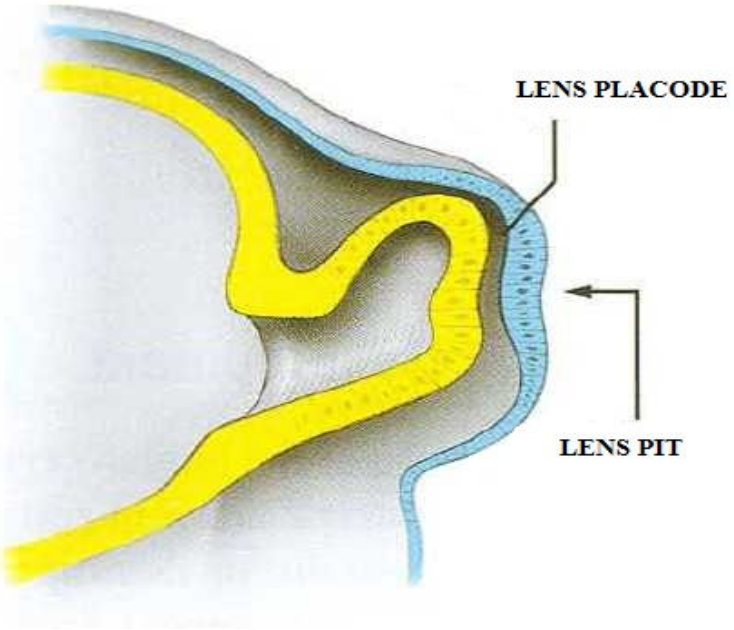


Fig.2 LENS PLACODE FORMATION

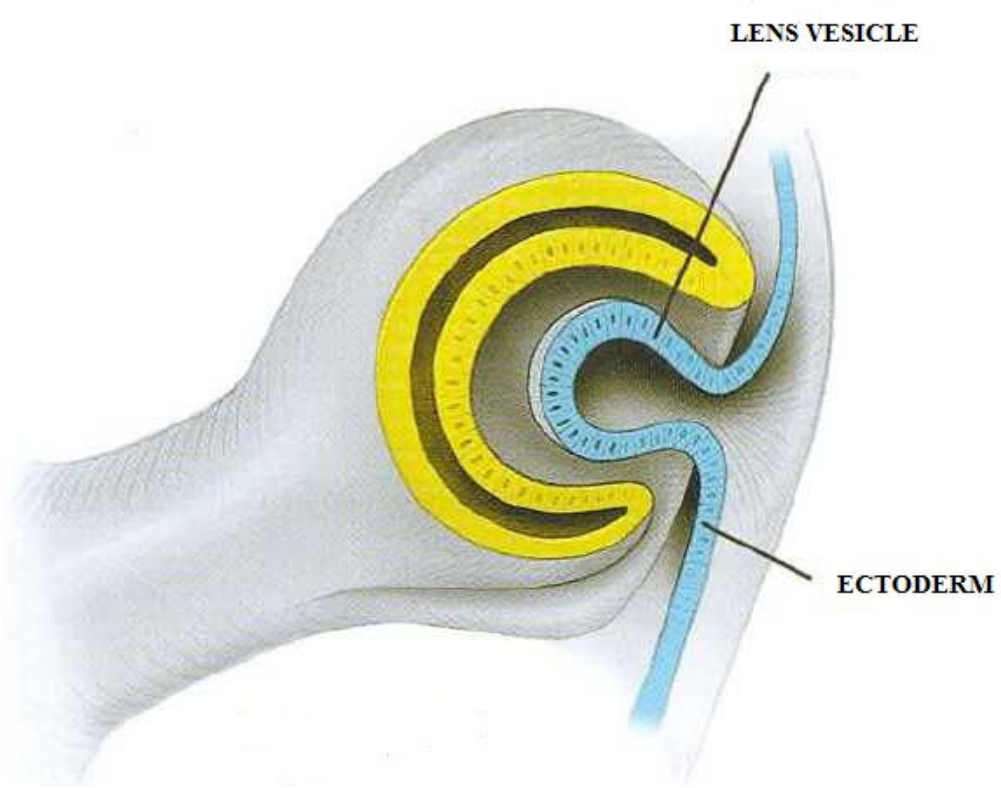
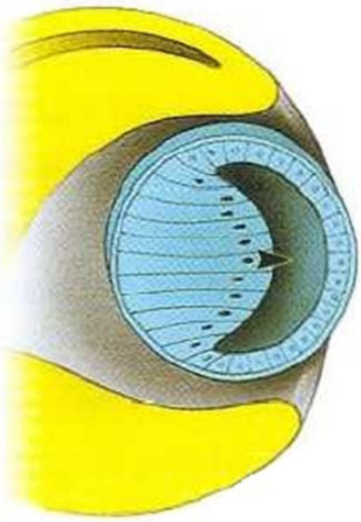


Fig.3 LENS VESICLE FORMATION



PRIMARY LENS FIBRES

Fig.4a

LENS VESICLE
COMPLETED

Fig.4b

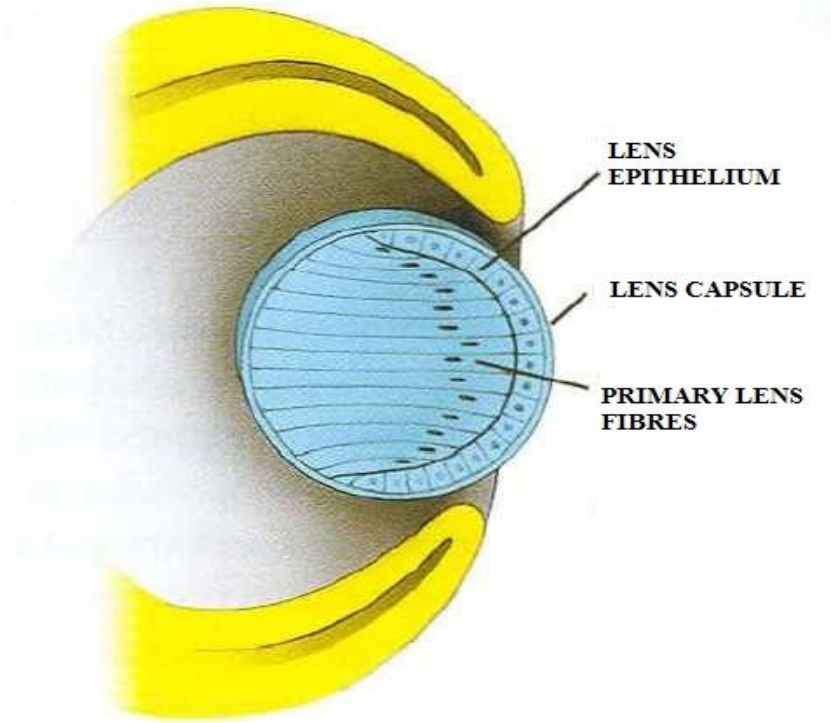


FIG 5. EMBRYONIC NUCLEUS FORMATION

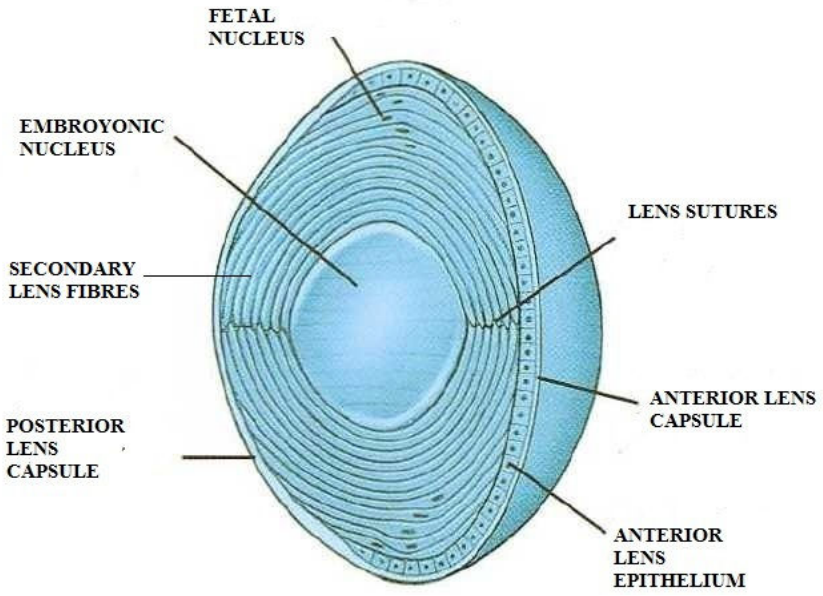


Fig 6. FETAL NUCLEUS

STRUCTURE OF LENS

1. LENS CAPSULE
2. LENS EPITHELIUM
3. LENS FIBRES

1. LENS CAPSULE:

It is an acellular hyaline collagenous membrane covers the lens completely .It is a thin, transparent basement membrane of the body composed of Type IV collagen and 10 per cent of Glycosaminoglycans laid down by the epithelial cells. It is thickest basement membrane in the body which is thicker anteriorly than posteriorly. It is highly elastic but doesn't contain elastic fibres. Ultra microscopically it is a lamellar structure.

2. ANTERIOR LENS EPITHELIUM:

It is a single layered cuboidal nucleated epithelial cells under the capsule containing all the cell organelles of a epithelial cell. So all the synthetic, transport and metabolic processes take place here. At equator few of its cells become columnar which forms the new lens fibres by actively dividing and elongating. This layer has the highest metabolic rate.

Anterior Lens Epithelium is divided into 3 zones -

A. Central zone:

Contains cuboidal cells. Undergoes mitoses only in conditions of injurious insult. These cells decrease with age. Metaplasia of this layer leads to anterior subcapsular cataract.

B. Intermediate zone:

Contains cylindrical cells which undergo occasional mitosis

C. Germinative zone:

Peripheral columnar cells which are located pre-equatorially forms this zone. It actively divides to form new cells which migrates posteriorly to form lens fibres. It is most susceptible to radiation. Dysplasia of these cells form the posterior subcapsular cataract.

3. LENS FIBRES:

Initially formed from the posterior epithelium that runs towards anterior part to fill the lens cavity and later derived from the equatorial region of the anterior epithelium. These fibres are long, thin, regularly arranged and forms the bulk of the lens. New lens fibres are arranged on the older deeper ones which are devoid of nuclei. In the newly formed fibres, the nuclei assume more anterior position which thereby forms a line more

convex anteriorly known as the nuclear bow. On cross section it is hexagonal in shape containing all organelles with more of ribosomes indicating more protein synthesis .There are interlocking processes between cells - ball and socket , tongue and groove interdigitations.

Zonular arrangement of the lens fibres:

Lens fibres are arranged in zones which shows the various period of its development as these fibres are formed throughout the life

Nucleus: central part containing the oldest fibres

Embryonic nucleus: Formed at 1-3 months of gestation. Lens fibres terminate by forming Y-shaped sutures, anteriorly it is erect and posteriorly it is inverted. As the development proceeds successive nuclear zones are laid down and depending upon the time of formation they are called

Foetal nucleus - 3 months of gestation till birth

Infantile nucleus -Birth to puberty

Adult nucleus - Till adult life

Cortex - contains recently formed fibres.

BIOCHEMICAL COMPOSITION OF LENS

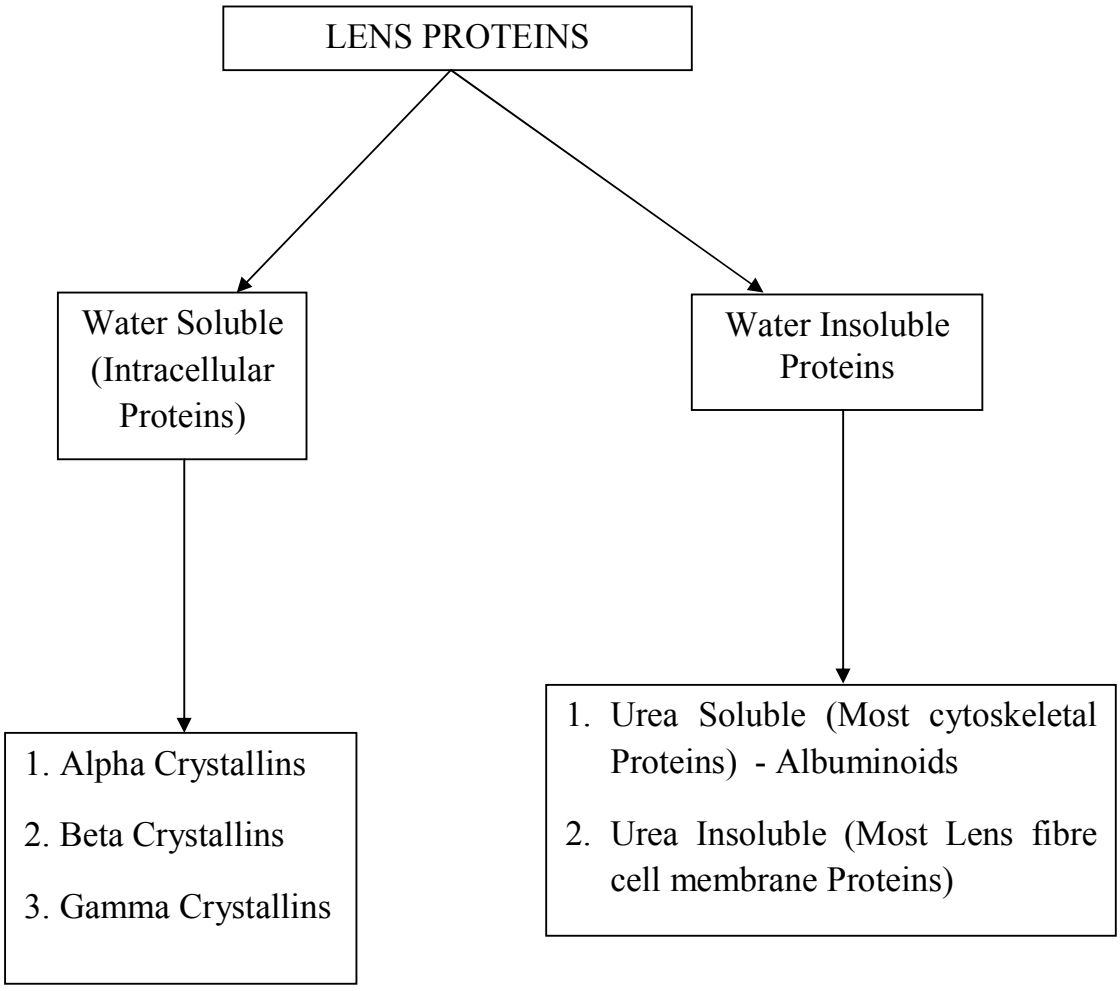
1. WATER:

Lens being a relatively dehydrated organ contains 65% water out of which 80% is free and 20% is bound. An active sodium pump is responsible for this dehydrated state. Cortex is more hydrated than the nucleus .Low amount of water in the lens is for maintaining a refractive index different from that of watery fluids at the two optical interfaces of the lens.

2. PROTEINS:

Highest concentration of proteins of any tissue in the body. Physical state of proteins is only responsible for lens transparency. It is synthesised in anterior epithelium and equator.

Cortex contains more soluble proteins than nucleus which contains more insoluble proteins. The concentration of albuminoids and alpha crystallins is inversely proportional. As age advances the soluble alpha crystallins is gradually converted into insoluble albuminoids.



A.WATER SOLUBLE PROTIENS:

Crystallins:

Alpha, beta and gamma crystallins are classified on the basis of their molecular weight, electrophoretic mobility and presence or absence of subunits. These form the bulk of lens proteins and are so called structural lens proteins.

(a) Alpha crystallins:

31.7%, highest molecular weight with greatest positive charge. It has A and B chains. A chain contains one thiol group per chain and molecular weight-19,500.B chain contains no thiol group and molecular weight is 22,500.

(b) Beta crystallins:

53.4%, heterogenous group of proteins with higher thiol content and have disulphide linkages. It contains three different polypeptide chain of 21000, 23000, 29000 molecular weight.

(c) Gamma crystallins:

1.5%, it is composed of monomers only. It is high in nucleus and low in cortex. Four proteins belong to this group having same molecular weight but differ in their chromatographic properties, amino acid composition and number of their sulphydryl groups.

B. WATER INSOLUBLE PROTEINS:

Main protein in this group is the albuminoids which constitutes 12.5% of total proteins. Most of it is urea soluble and derived from the alpha crystallins.

Other lens proteins include glycoproteins which is primarily associated with lens cell membrane and are seen more in the cortex, nucleoproteins, lipoproteins, phosphoproteins and fluorescent proteins.

4. CARBOHYDRATES:

Glucose, fructose, glycogen are the free carbohydrates found in the lens while the derivatives of sugar include: sorbitol, inositol, ascorbic acid, gluconic acid and glucosamine.

Glucose : Level various from 20 to 120 mg%. The lens gets its glucose from aqueous .Aqueous has ten times more glucose than present in lens.

Fructose: Its concentration varies with age. In the lens it is produced from glucose.

Glycogen: Only traces have been found in lenses. Its concentration also varies with age. It is located principally in the nucleus where it replaces gamma crystallin thereby increasing refractive index.

5. LIPIDS:

2.5% of wet weight of lens. In lens, lipid is in two forms: *Free form* and *Bound form* as lipoproteins. Lipids are most abundant in epithelial cells in children and in the cortex in adults. The main lipid substances are cholesterol and various phospholipids. It functions as lubricating cement substance between the lens fibres. The cholesterol content increases with age in the nucleus but the glycerides decrease. In cataracts, the concentration of free lipids increase and lipoproteins decrease.

5. ELECTROLYTES:

Potassium is the predominant cation in lens and is higher in lens than any other eye tissue. Sodium concentration is twice more in the superficial cortex compared to nucleus. Calcium is lowest of all the eye tissue while other anions include chloride, bicarbonate,phosphate and sulphates.

6. ORGANIC PHOSPHATES:

These include adenosine and pyridine nucleotides, glycerophosphates and related esters. Adenosine triphosphates are important constituents essential for phosphorylation of glucose.It declines with development of cataract and age

7. GLUTATHIONE:

Levels vary from 200-450 mg/100gm lens. Its levels decreases with age and this decrease is relative due to increase in weight of the lens with age. It is a tripeptide made of three amino acids- glycine, cysteine and glutamic acid. It is known as gamma-glutamyl cysteinyl glycine. Among these three cysteine is the most reactive constituent because of the presence of sulphydryl group and is responsible for it to exist in two forms- oxidised and reduced glutathione. The former contains cystine while the latter contains cysteine. More than 95 % of it is in the reduced state. Oxidised glutathione is converted to reduced form by glutathione reductase, the source of hydrogen is from NADPH from HMP shunt.

There is a correlation between the concentration of glutathione and the tissues activity. Glutathione is responsible for the redox systems inside the lens. It is produced in lens cells from the interaction between glutamate and cysteine. Glutathione peroxidise and glutathione-S-transferase are effective antioxidants to protect the lens from constant attack by oxidative agents. It is important in protecting thiol groups of especially cation transporting membrane proteins in the lens. Other effective enzyme systems to null the effect of oxidants include: catalase and superoxide dismutase.

8. ASCORBIC ACID:

30 MG/ 100 gm. wet weight of the lens. Its concentration is greater in the lens than in aqueous. It is neither synthesised nor actively transported in lens. A portion of it is protein bound which can account for its accumulation inside lens. The conversion between ascorbic acid and its oxidised form dehydroascorbic acid can be coupled with other oxidation reduction systems in the lens. In HMP Shunt it participates and causes modulation and act as free radical scavenger.

There is an inverse association of Blood Vitamin C level is seen in increasing age, low socioeconomic status, high outdoor exposure, smoking, bio mass fuel usage and poor nutrition.

NORMAL CONSTITUENTS OF LENS

WATER	66% OF WET WEIGHT
PROTEIN	33% OF WET WEIGHT
SODIUM	17 meq/kg lens water
POTASSIUM	125 meq/kg lens water
CALCIUM	0.4meq/kg lens water
CHLORIDE	30 meq/kg lens water
GLUCOSE	1mM
GLUTATHIONE	12mM
ASCORBIC ACID	1.6mM
LIPIDS	28 mg/wet weight
INOSITOL	5.9mM
LACTIC ACID	14mM

COMPOSITION OF AQUEOUS HUMOR & PLASMA

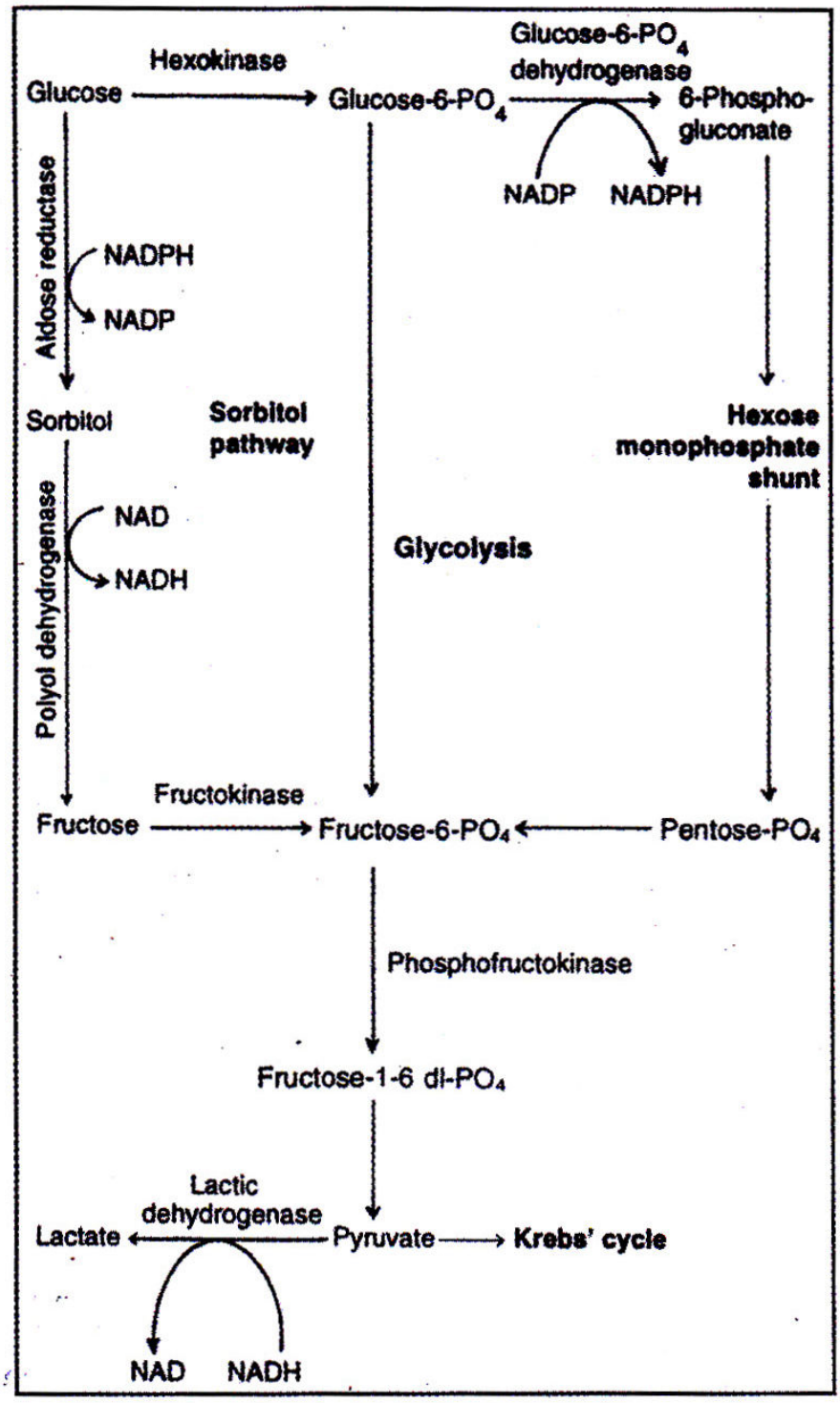
COMPONENTS	AQUEOUS HUMOR	PLASMA	UNITS
GLUCOSE	2.7-3.9	5.6-6.4	mmol/l
LACTATE	4.5	0.5-0.8	mmol/l
ASCORBATE	1.1(19 mg %)	0.04(1.3mg %)	mmol/l
ALBUMIN	5.5-6.5	3400	mg/dl
TRANSFERRIN	1.3-1.7	-	mg/dl
FIBRONECTIN	0.25	29	mg/dl
IgG	3	1270	mg/dl
PHOSPHATE	2.1	3.8	mg/dl
GLOBULIN	5	2900	mg/dl
SODIUM	142	130-145	meq/l
POTASSIUM	4	3.5-5	meq/l
BICARBONATE	20	24-30	meq/l
CHLORIDE	131	92-125	meq/l
CALCIUM	1.2	2-2.6	meq/l
MAGNESIUM	1	0.7-1.1	meq/l
pH	7.5	7.4	

METABOLIC ACTIVITIES OF THE LENS

Lens metabolism happens in such a way to maintain the transparency and main location metabolism occurs is lens epithelium.

A.GLUCOSE METABOLISM:

Glucose is very essential for the normal working of the lens. Its metabolism accounts for the major source of energy. Lens requires continuous supply of ATP for active transport of amino acids and ions, protein and GSH synthesis, maintenance of its dehydrated state and contributing to lens transparency. Most of the energy produced is utilised in the epithelium and 70% of it is derived from anaerobic glycolysis. When the glucose stores gets depleted lens starts using its endogenous energy reserves and begins to gain water and lose its transparency. Lens derives its glucose mainly from the aqueous and the vitreous.



Pathways of Glucose Metabolism in the Crystalline Lens

PATHWAYS OF GLUCOSE METABOLISM IN THE LENS

S.NO	PATHWAY	MAIN INTERMADIARIES	END PRODUCTS	GLUCOSE THROUGH PATHWAY (%)	MOLECULES OF ATP GAINED
1.	GLYCOLYTIC (ANEROBIC)	GLUCOSE-6-PHOSPHATE; FRUCTOSE 1-6 DIPHOSPHATE; PYRUVIC ACID	LACTIC ACID	80%	2
2.	KREBS CYCLE (OXIDATIVE)	TRICARBOXYLIC ACID	CO_2,H_2O	5%	36
3.	PENTOSE SHUNT (HMP)	PENTOSES	CO_2,NADPH	15%	-
4.	SORBITOL PATHWAY	SORBITOL FRUCTOSE	LACTIC ACID	UNKNOWN	2

PROTEIN METABOLISM:

Amino acids are actively transported into the lens from aqueous from which the proteins are synthesised. Appropriate RNA template and ATP are required for the formation of peptide from the amino acids. Rate of protein synthesis varies in different part of the lens with in nucleus the process being the slowest. Peptidases and proteases are responsible for the protein breakdown in the lens.

LENS TRANSPARENCY:

Lens being a transparent structure transmits 80 % of light energy. Many factors contributing to its transparency include:

a. Lens capsule being semipermeable in nature

b. Single layered epithelial cells

c. Arrangement of lens proteins.

d. Lens cells are sparse and highly packed.

e. Pump mechanism in the lens which regulates the water and electrolyte balance and thereby contributes to the relatively dehydrated state of the lens.

f. Lens being an avascular structure.

g. The integrity of the pump is ensured by the reduced state of the lens proteins which is contributed by the high concentration of reduced glutathione in the lens.

CHANGES IN AGEING LENS:

PHYSICAL CHANGES :

As a result of continued growth of the lens throughout life, its weight and thickness increases steadily with age. With increasing age, light transmission decreases and light scattering increases due to synergism-aggregation and formation of gel like state because of certain changes in

proteins release bound water causing certain differences in refractive index between drier protein region and its surroundings.

METABOLIC CHANGES:

With increasing age epithelial proliferative capacity and metabolic activities of the lens decreases. Many enzymatic activities decline. Both glutathione and ascorbate levels decrease in lens with age. Three enzymes of glutathione metabolism do not decrease with age, these include- glutathione peroxidise, glutathione reductase and glutathione-S-transferase. There occurs an increase in urea soluble proteins.

CHANGE IN CRYSTALLINS:

Age related loss of gamma crystallins occurs and there is an increase in disulfide bonds in it. Alpha crystallins almost disappear from soluble extract from nucleus while the beta crystallins become more polydisperse.

CHANGES IN PLASMA MEMBRANE AND CYTOSKELETON:

Age related loss of membrane proteins, lipids, potential, rigidity and cytoskeletal proteins occurs, and increase in lens sodium and calcium takes place.

CATARACT

Any opacity of the lens or its capsule causing visual impairment is called cataract .There is no classification of cataract which is entirely satisfactory.

ETIOLOGICAL CLASSIFICATION OF CATARACT

A. Congenital or Developmental cataract

B. Acquired cataract

1. Senile
2. Traumatic - Mechanical, Irradiation and Electric shock
3. Complicated - Anterior uveitis, High myopia, Retinal detachment, Retinitis pigmentosa, Glaucomaflecken.
4. Secondary - Diabetes mellitus, Hypocalcemia, Myotonic dystrophy, Atopic dermatitis
5. Toxic- Corticosteroids, Chlorpromazine, Amiodarone, Busulphan, Miotics, Gold.
6. Syndromes: Downs, Alports, Stickler, Treachers-Collins, Wilson's disease and Fabrys disease.

LENS OPACITIES CLASSIFICATION SYSTEM:

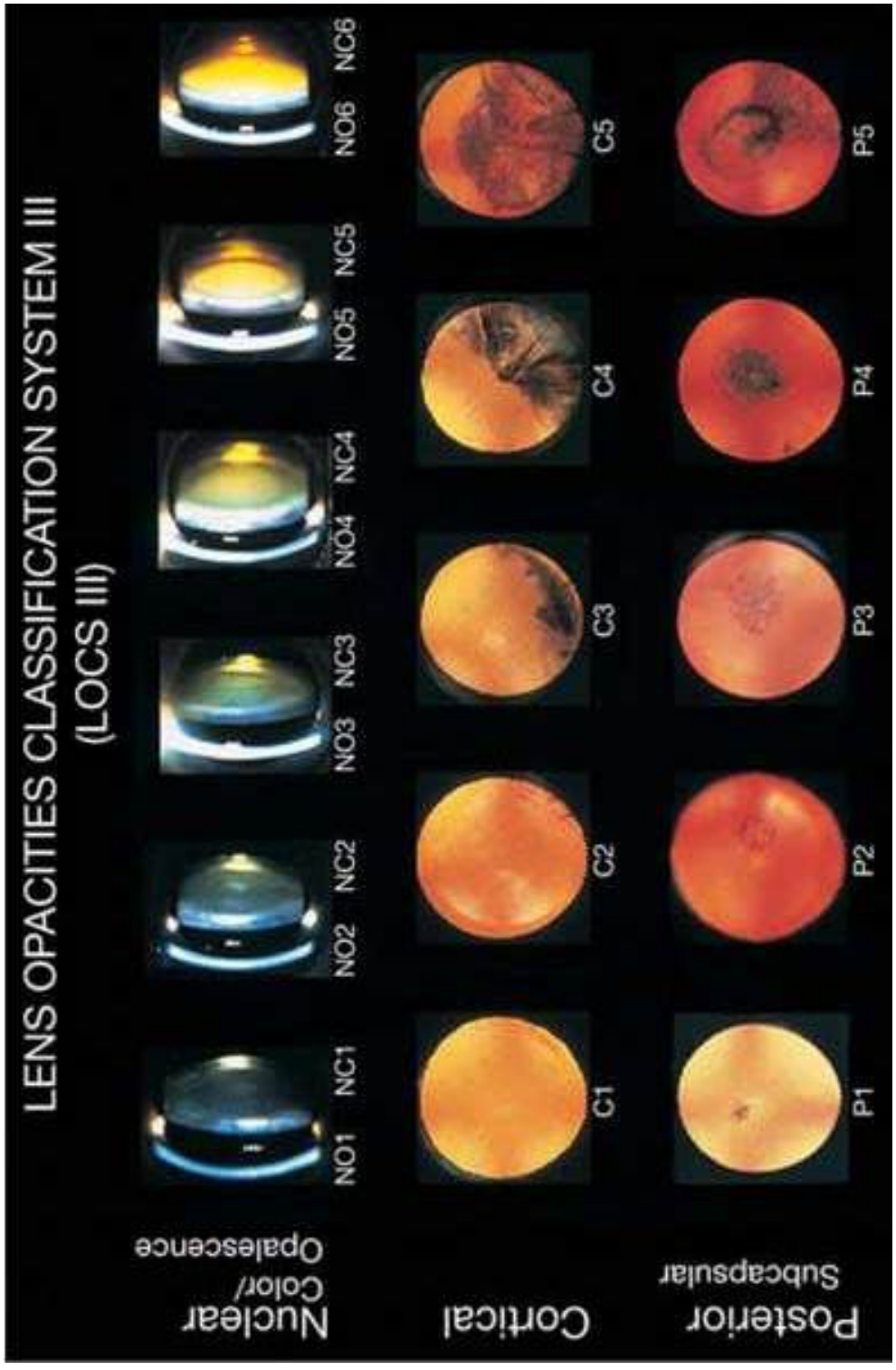
It is a research instrument used for classification of Lenticular Opacities in different zones and its progression by Chylack et al, based on the expanded set of Standard Photographs selected from an Epidemiology Study Called "Longitudinal Study of Cataract". Previously LOC I & LOC II was used, Now LOC III classification has been developed and is commonly used.

LOCS III is a classification system for quantifying cataract measure in cataractous lenses. It contains Slit-lamp images

Nuclear Cataract - 6 Slit lamp images
- Nuclear Colour(NC) & Nuclear Opalescence(NO)
- From NO1/NC1 to NO6/NC6

Cortical Cataract - 5 Retro illumination images
- From C1 to C5

Posterior Subcapsular Cataract - 5 Retro illumination images
- From P1 to P5.


LENS OPACITIES CLASSIFICATION SYSTEM III
(LOCS III)
Nuclear color/ Opalescence
Cortical
Posterior Subcapsular
NO1 NC1 NO2 NC2 NO3 NC3 NO4 NC4 NO5 NC5 NO6 NC6
C1 C2 C3 C4 C5
P1 P2 P3 P4 P5

MORPHOLOGICAL CLASSIFICATION:

There are three types of age related cataract: nuclear, cortical and posterior subcapsular.

a. NUCLEAR CATARACT:

Degenerative nuclear sclerosis coupled with nucleus dehydration and compaction results in hard cataract and increase in water insoluble proteins. It causes greater impairment in distant vision than for near because of the increase in refractive index of the lens and thereby causing myopic shift. This myopic shift leads to a condition called second sight in which presbyopic individuals who can read comfortably without their spectacles. In nuclear cataract there occurs progressive yellowish discolouration and in advanced stages turns brown leading to the formation of brown cataract (brunescent cataract) as it progresses still further it turns black (cataracta nigra).

b. CORTICAL CATARACT:

Progressive decline in lens proteins and free amino acids in the lens and also the alteration in water and electrolyte balance occurs which leads to the formation of cortical cataract. Here water content and weight of the lens increases. Conversion of soluble to insoluble proteins occurs. Decreased production coupled with increased catabolism of protein occurs. These

patients present more commonly with glare as the chief complaint. Initial signs include vacuoles and water clefts .Wedge shaped opacities called cortical spokes or cuneiform opacities form near the periphery of the lens. These opacities spread out to adjacent fibre cells causing the opacity to increase in size and affects the visual axis.

c. POSTERIOR SUBCAPSULAR CATARACT:

Posterior subcapsular cataract also known as cupuliform cataract is located in the posterior cortical layer .It is usually axial. Causes more difficulty in near vision than for distance. It presents as a saucer shaped opacity in the posterior cortex just beneath the capsule. In the later stages it produces granular or plaques like opacities. This cataract is more common following steroid intake, trauma, following inflammation and exposure to ionising radiation.

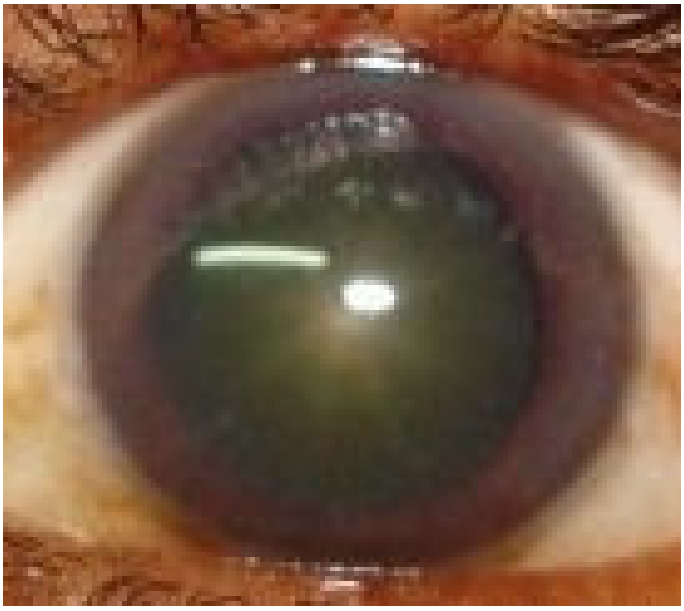
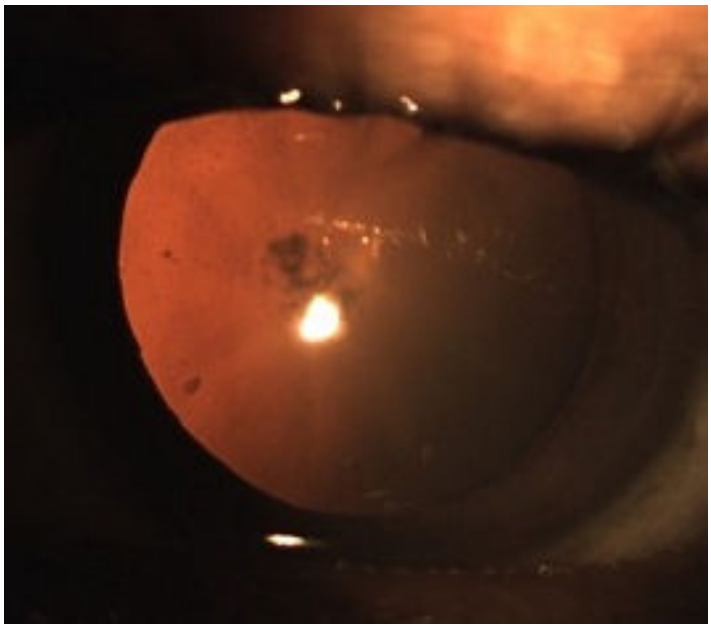
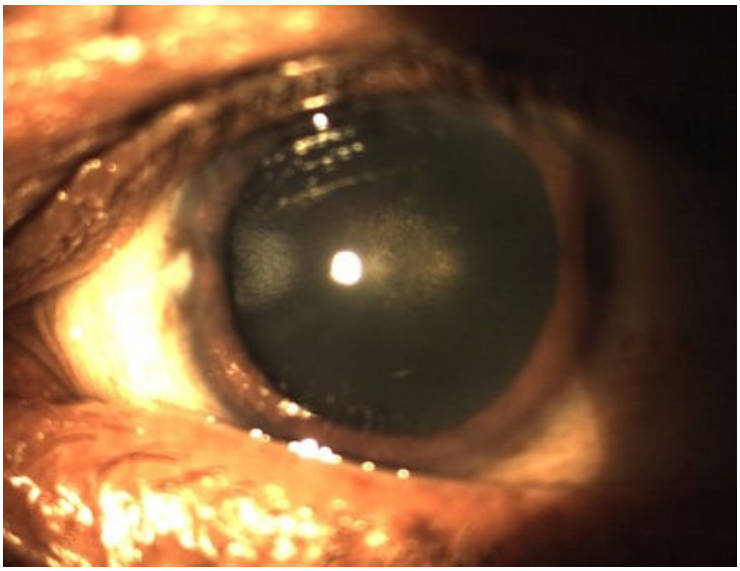


Fig.7 EARLY GRADE NUCLEAR CATRACT

Fig .8 BROWN CATARACT





Fig, 9a & 9b POSTERIOR SUBCAPSULAR CATARACT

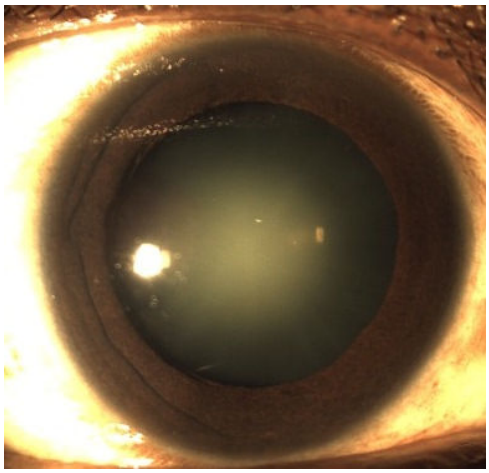


Fig.10 EARLY IMMATURE CORTICAL CATARACT

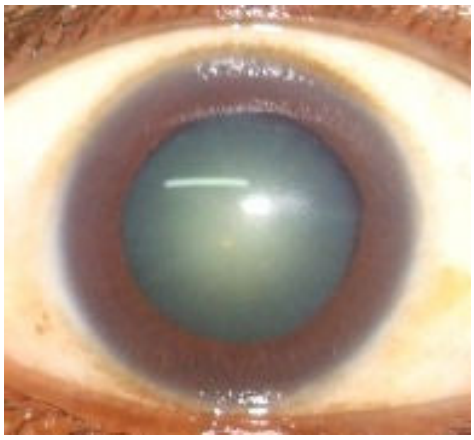


Fig.11 IMMATURE CORTICAL CATARACT

Fig.12 HYPERMATURE CATARACT

RISK FACTORS AFFECTING DEVELOPMENT OF CATARACT

1. Heredity
2. Ultraviolet radiation:

High prevalence of cataract in tropical countries can be attributed to ultraviolet radiation. It is responsible for early onset and maturation of cataract. UV radiation between 290 and 320 nm could cause lens opacification. Prolonged exposure to UV rays induce photooxidative damage to lens which in turn is responsible for cataract formation. Near UV light is absorbed by tryptophan which in turn is converted to N-formyl kynurenine and 3-OH-kynurenine which act as photosensitisers producing free radical single oxygen. This affects the activities of many lens enzymes such as Na/K + ATPase and leads to lens opacity. This light induced lens damage is reduced by Vitamin C, Vitamin E and Glutathione.

3. Nutrition:

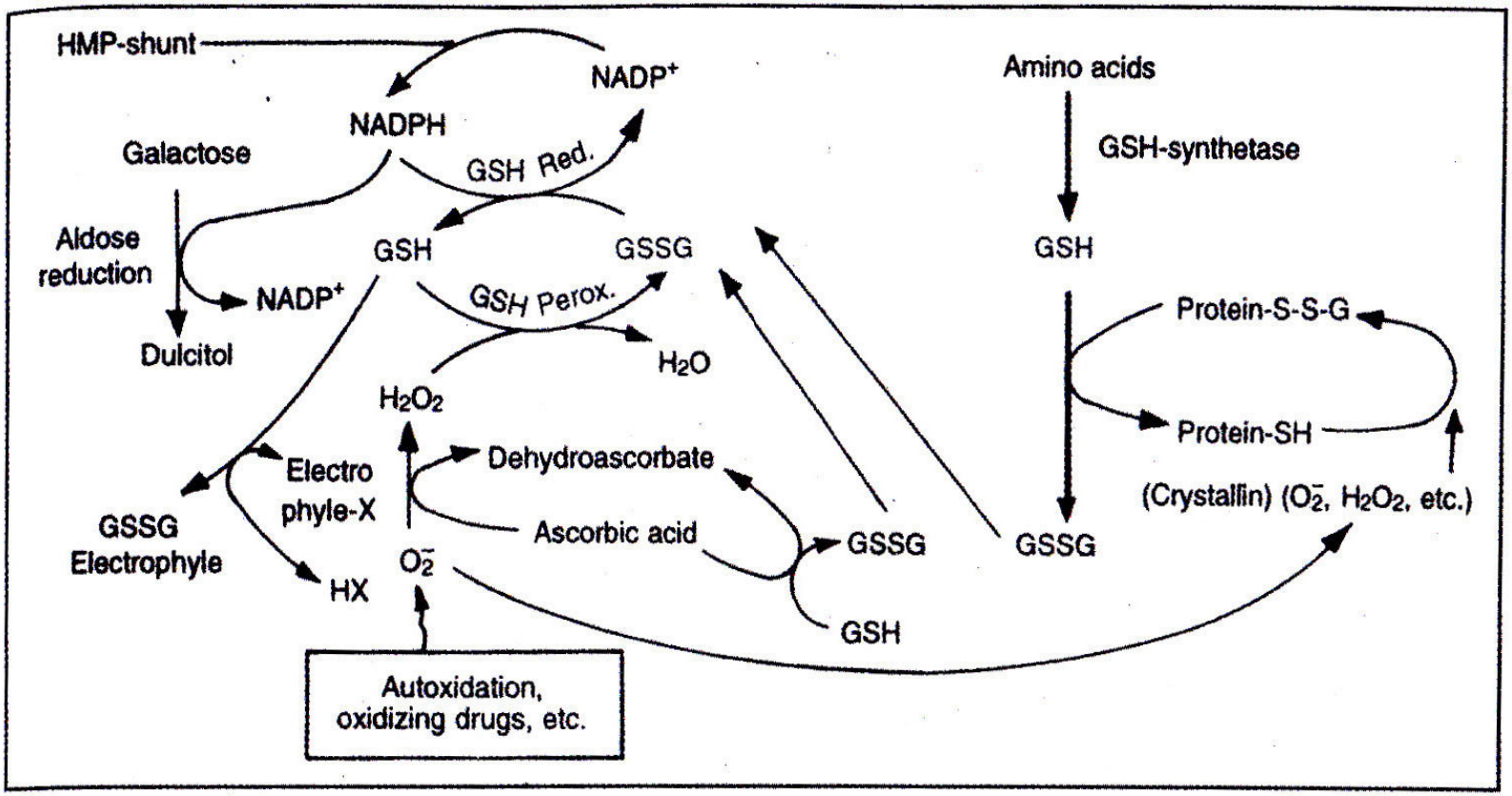
Various population based studies have shown increased prevalence of cataract in low socioeconomic status, low education level and overall poor nutrition. High Blood levels of beta carotenoids seem to have a protective effect. Some studies have suggested that taking multiVitamin supplement such as Vitamin A, C, E, Niacin, Thiamine, Riboflavin, Beta carotene and

increased protein intake have protective mechanism against developing cataract.

4. Body mass index: Higher body mass index increases the risk of developing cortical opacities and PSCC.
5. Diabetes and Hypertension
6. Severe diarrhoea
7. Renal failure
8. Myopia
9. Diuretics and steroids
10. Smoking or other tobacco products: Avoidable significant risk factor for cataract. There is increased association in development of nuclear opacity and other then cataract it produce macular degeneration. Some smoking related damage to the lens may be reversible and its cessation reduces the risk of developing cataract.
11. Glaucoma
12. Alcohol

ROLE OF GLUTATHIONE AND ASCORBIC ACID IN PREVENTING CATARACTOGENESIS

Free radicals like superoxide anions, hydrogen peroxide, lipid peroxides and lipid hydroperoxides cause oxidative damage to lens. Among these superoxide radicals being the most toxic to lens proteins. Damage to the cytoskeleton can occur due to oxidative stress. Lens has protective mechanisms to deal with this oxidative damage. Ascorbic acid and glutathione are a part of such protective mechanisms. Ascorbic acid is considered to be the physiological scavenger of superoxide anions. It converts highly reactive superoxide to less reactive hydrogen peroxide. Glutathione too has similar mechanisms. Therefore in decreased concentrations of glutathione and ascorbic acid the oxidants accumulate causing oxidation of protein hydrals such as enzymes, membrane proteins, and crystallins leading to oxidative damage to lens and thereby causing cataract.



Ascorbic Acid and Glutathione Scavenging Pathway in Crystalline Lens

HISTORY OF CATARACT SURGERY

The first documented treatment for cataract was couching done in early fifth century BC .It was practiced in India by Susruta, a Hindu surgeon. Iraqi ocularist Ammar developed a technique that involved suction aspiration of the cataract through a hollow needle in 996-1020 AD. In 1747, Jacques Daniel performed the first reported extracapsular cataract extraction but that technique had complications of poor wound healing, uveal, vitreal and retinal prolapse, inflammation and infection. In 1753, Samuel Sharp performed the first successful ICCE removing the cataractous lens with intact capsule through a limbal incision but the main problem faced in this procedure is breaking or lysis of the zonular fibres.

Modern advances in intracapsular surgery include chemical dissolution of the zonular fibres with alpha chymotrypsin which was first reported in 1957 by Joaquin Barraquer. The cryoprobe lens extraction has replaced capsular forceps and suction devices like erysiphakes. Modern ICCE is advantageous in patients with subluxed or dense cataracts and patients with pseudoexfoliation even in the best surgical facilities available.

Extracapsular cataract extraction (ECCE) technique which consists of making an opening in capsule, removing the nucleus and washing the cortex

has replaced ICCE. It consists of various techniques based on incision size, shape of capsulotomy, instruments and techniques used.

a. Conventional ECCE
b. Small incision cataract surgery
c. Phacoemulsification

In 1967, phacoemulsification was first introduced by Charles Kelman who used ultrasonically driven tip to fragment and to emulsify the nucleus. These fragments are aspirated by surgeon controlled automated aspiration through a small 3-3.5 mm incision by a phaco tip with silicone sleeve. The advantages of phacoemulsification are more rapid visual rehabilitation, wound related complication are less, faster healing, relatively closed chamber which safeguard against choroidal haemorrhage and vitreous pressure. Foldable IOL should be implanted following phaco because of small incision.

d. Newer phacoemulsification methods employing microincision techniques (MICS) in the cornea so that incision size decrease from 3mm to 1.2mm. Methods using MICS are

Bimanual phacoemulsification - Incision size 0.8mm to 1.5mm

- Separate irrigation and aspiration
- Sleeve less phaco tip

Micro coaxial phacoemulsification - Incision size 2.0mm to 2.2mm

-Better Fluidics

-most accepted method

These methods of cataract surgery have the advantages of reduced astigmatism and increased wound healing.

OPHTHALMIC VISCOSURGICAL DEVICES:

These viscoelastic agents used in cataract surgery decreased the incidence of corneal edema following ECCE, SICS and phacoemulsification surgeries. OVDs include the following substances: sodium hyaluronate, chondroitin sulphate or hydroxypropylmethyl cellulose in varying concentrations. These perform the main functions of space maintenance, easy injection and tissue manipulation, surface coating, shock absorption and increases the optical clarity. The physical properties of OVDs are: viscosity, viscoelasticity, surface tension and pseudoplasticity. Based on these properties these can be classified as: Cohesives and Dispersives.

Cohesives have high molecular weight with higher pseudoplasticity and surface tension, so these adhere to each other. These agents are used as space maintainer, shock absorption, can be easily aspirated and removed from the eye. These are Sodium Hyaluronate biopolymer examples are Healon, Healon GV, Amvisc, Ocucoat and Provisc.

Dispersives have comparatively low molecular weight, lower surface tension, good coatability and lesser tendency to adhere to each other. These are removed less rapidly from the eye, made up of Hydroxy propyl methyl cellulose examples are Viscoat and Vitrax.

ANAESTHESIA FOR CATARACT SURGERY:

Historically cataract surgery was first performed without anaesthesia. In late 1800s topical cocaine was used by Karl Koller. The modern techniques of various anaesthesias employed include:

a. Local anaesthesia

Facial-Van Lint's, Nadbath, Atkinson's or O' Brien's block

Retrobulbar block, Peribulbar block, Subconjuctival lidocaine and Sub Tenon lignocaine.

b. Surface or Topical anaesthesia

c. General anaesthesia for pediatric, mentally challenged and extremely apprehensive patients.

INTRAOCULAR LENSES:

Sir Harold Ridley in 1949 observed that PMMA fragments are not producing any reaction in the eye and this lead to him placing the first IOL in the eye. First Foldable IOL made of silicone was developed and implanted by Thomas Mazzocco in 1980.

Materials used in the manufacture of IOLs include:

OPTIC MATERIALS:

Non foldable - PMMA

Foldable - Silicone, Hydrophobic acrylic, Hydrophilic acrylic.

HAPTIC MATERIALS:

Polypropylene, PMMA and acrylic.

Depending on the IOL placement they are classified into:

ANTERIOR CHAMBER IOLs:

Angle supported IOLs, Iris fixated IOLs

POSTERIOR CHAMBER IOL:

Ciliary sulcus fixation, in the bag fixation and Scleral fixation.

Based on IOL design, they can be classified as:

Single piece and multipiece IOLS,

Plate haptic and loop haptic IOLs,

Aspheric and spheric IOL optic designs,

Round optic edge and sharp optic edge IOL optic designs,

Haptic designs and angulation.

NEWER IOLs:

1. Accomodating IOLs:

This IOLS are meant for restoring the accommodation after the cataract surgery in the eye, for surgical presbyopic correction and for increasing the depth of focus. Examples of accommodative lens are: Crystalens AT- 45 Bausch and Lomb.

2. Multifocal IOLs:

Three types of multifocal IOLs found to be effective. This includes: Refractive, diffractive and apodised diffractive optics.

3. TORIC IOLs:

It is meant for the purpose of correction of astigmatism.

4. Light Adjustable IOLS:

Allows re-adjustment of IOL power postoperatively by the principle of photochemistry and diffusion.

IOL POWER calculation:

To achieve emmetropia postoperatively significant improvements have been made in IOL power determination. Many regression formulas have been used to calculate IOL power. The most widely used is the Sanders –Retzlaff- Kraff formula. (SRK) which is

P=A-2.5 L-0.9 K where

P=Lens implant power for emmetropia (dioptre)

L=Axial length (mm)

K=Average keratometric reading (dioptres)

A=Constant specific to the lens implant to be used.

For IOL power calculation in eyes whose axial length lies outside the range of 22-25 mm newer versions of regression formulas have been devised: SRK/T, Holladay 2, Hoffer Q, Haigis.

AIM & OBJECTIVES OF THE STUDY

An analytical observational clinical study on correlation of Blood Vitamin C level with cataract in middle aged people was done. The aims of the study were

Primary Objective:

To examine the association between Blood Vitamin C level with cataract in middle aged people.

Secondary Objective:

To analyse other risk factors affecting Blood Vitamin C level and the factors associated with cataract development in middle aged people.

METHODOLOGY (MATERIALS & METHODS)

Subject Selection:

Patients in the middle aged group of 30-50 years who presented to RIO GOH hospital with cataract without any secondary cause were subjected to detailed clinical history evaluation, ocular examination, general examination and Blood Vitamin C level estimation by Spectrophotometer method .Data's were collected earlier and the study was conducted over a period of four months.

Inclusion Criteria:

1. Patients in age group of 30-50 years in both genders.

2. Patients presenting with

a. Bilateral Cataract and

b. Unilateral cataract with other eye pseudophakia or aphakia or clear lens or lens changes.

Exclusion Criteria:

1. Patients aged <30 years and >50 years in both genders.
2. Patients with other ocular diseases like glaucoma, uveitis, myopia
3. Patients who had ocular trauma-mechanical, irradiation, electric shock.
4. Patients who are having diabetes mellitus, and random Blood sugar value more than 140 mgs/dl
5. Patients with other systemic diseases like hypocalcemia, myotonic dystrophy and atopic dermatitis.
6. Patients with History of drug intake like steroids, miotics, Amiodarone, Chlorpromazine and others.
7. Patients those who are on multi vitamin supplements
8. Patients with family history of cataract
9. Female patients who are in antenatal/ postnatal period.

SCREENING AND PROCEDURES

20 patients of our study group who had bilateral Cataract or Unilateral cataract with other eye pseudophakia / aphakia / clear lens/ lens changes were enrolled and detailed clinical examination done. Age of the patient was confirmed by date of birth bearing ID cards or Education certificates. Nature of defective vision has been evaluated. History wise, patient were questioned about any symptom of eyes in relating to ocular disease in the past. History of wearing any spectacles, any ocular trauma and any previous intraocular surgery were also evaluated.

Systemic disease in development of cataract was ruled out by clinical history evaluation.

H/O Diabetes mellitus, any systemic disease like Myotonic Dystrophy, Hypocalcemia, Atopic dermatitis ,any drug intake (Steroids, Miotics, Amiodarone, Chlorpromazine ,others), H/O any Multivitamin intake, H/O antenatal/post natal ,and Family h/o cataract presented in early age. Other history evaluation was also done, like

Past History: Any past H/O TB, Asthma, HT, Arthritis, IHD

Personal H/O: .Diet, H/O tobacco use, H/O alcohol intake.

Occupational H/O: Recent and in Past, Amount of outdoor exposure to sunlight, Education, Marital status, Status of living, Economic status, and Household cooking fuel.

General examination of the patient, Height, Weight, BMI (Weight/Height in m^2), Blood Pressure and Nutritional status was assessed. As per Body Mass Index patients are classified into Underweight: < 18.5 BMI, Normal weight: $\geq$ 18.5 to < 25 BMI, Overweight and obese: $\geq$ 25 BMI. Systemic examination CNS, CVS, RS and Abdomen was done.

Then patients were subjected to Ocular examination:

Vision, Intra ocular pressure, Slit lamp examination, A scan, keratometry, IOL power calculation, syringing of nasolacrimal duct, B scan & Fundus examination.

Blood Investigation, Blood Vitamin C level estimation through Spectrophotometer and Random Blood sugar was done.

Follow up Procedures / Visits:

After evaluation patient has undergone Cataract surgery with posterior chamber intraocular lens implantation.

Follow up:1^{st} postoperative day, 1 week, 1 month

POST OPERATIVE : Visual acuity,Refraction

Slit lamp examination

Fundus examination

Assessments of Parameters:

1. Blood Vitamin C level estimation values are compared with normal values in this age group.
2. To analyse other risk factors affecting Blood Vitamin C level and the factors associated with cataract development in this age group.

BIOCHEMICAL METHOD OF ESTIMATION OF VITAMIN C IN PLASMA

PRINCIPLE:

Ascorbic acid in plasma is oxidised by Cu (II) to form dehydroascorbic acid which reacts with 2, 4-dinitrophenylhydrazine to form a red bis-hydrazine which is measured at 520 nm.

PERFORMANCE SPECIFICATIONS:

This method is linear upto 2 mg/l. This method has a measurement range of 0.5-2 mg/l. The minimum detection limit by this method is 0.1 mg/l.

PRIMARY SAMPLE:

Use only heparinised plasma as specimen for the test. We should not use lysed plasma for testing as it may give very high results and not use contaminated/turbid samples for testing. Process the sample immediately on the same day. As soon as received the plasma is treated with 6 % metaphosphoric acid and processed immediately, if not the supernatant is stored at -20 degree C.

TYPE OF CONTAINER AND ADDITIVE:

Add 20µl of heparin in plain tube for collecting sample.

REAGENTS/CONSUMABLES:

A. METAPHOSPHORIC ACID SOLUTION (6.0 g/dl): Dissolve 30 g of metaphosphoric acid in distilled water and bring to a final volume of 500 ml. Prepare immediately before use.

B. SULPHURIC ACID (4.5 mol/l): Add slowly 250 ml of concentrated sulphuric acid, reagent grade to 500 ml of cold water in a 1 L flask and fill to mark with distilled water.

C. SULPHURIC ACID (12 mol/l): Add 650 ml of concentrated sulphuric acid to 300 ml of cold water in a 1 l flask, cool, and fill to mark with distilled water. The concentrated acid should be added slowly to water in small quantities at a time and the resulting solution mixed constantly and refrigerate.

D. 2,4 DINITROPHENYLHYDRAZINE REAGENT: 2 g/dl in sulphuric acid,4.5 mol/l. Dissolve 10 g of 2,4 dinitrophenylhydrazine in sulphuric acid,4.5 mol/l, and dilute to a final volume of 500 ml. Let it stand in the refrigerator overnight and then filter.

E. THIOUREA SOLUTION, 5 g/dl: Dissolve 5 g of thiourea in distilled water and dilute to a final volume of 100 ml. This reagent is stable for 1 month at 4 degree C.

F. COPPER SULPHATE SOLUTION, 0.6 g/dl: Dissolve 0.6 g of anhydrous copper sulphate in distilled water and dilute to a final volume of 100 ml.

G. DINITROPHENYLHYDRAZINE-THIOUREA-COPPER SULPHATE SOLUTION REAGENT: Combine 5 ml of the thiourea solution, 5 ml of the copper sulphate solution and 100 ml of 2, 4 dinitrophenylhydrazine reagent. Store in a bottle at 4 degree C for a maximum of 1 week.

H. CALIBRATORS: All ascorbic acid calibrators should be prepared freshly.

I. ASCORBIC ACID CALIBRATOR, 50 mg/dl: Dissolve 50 mg of ascorbic acid in metaphosphoric acid (6g/dl) and bring to a final volume of 100 ml with metaphosphoric acid.

J. INTERMEDIATE ASCORBIC ACID CALIBRATORS, 5 mg/dl: Pipette 10 ml of stock calibrator into a 100 ml calorimetric flask and dilute to mark with metaphosphoric acid (6g/dl).

K. WORKING CALIBRATORS: In a series of 25 ml volumetric flasks, pipette the following amounts of intermediate calibrator: 0.5, 2, 4, 6, 10,

15 and 20 ml. Bring to final volume of 25 ml with metaphosphoric acid to yield working calibrators of 0.10, 0.4, 0.8, 1.2,2,3 and 4 mg/dl.

INSTRUMENT: Spectrophotometer

PROCEDURE:

0.5 ml of heparinised plasma to 2 ml of freshly prepared metaphosphoric acid in a test tube and mixed well. Centrifuge this mixture at 2500rpm for ten mins. Pipette 1.2 ml of the clear supernatant mixture into test tube. Add 1.2 ml of each concentration of working calibrator into test tubes. Prepare the calibrators in duplicate. Add 1.2 ml of metaphosphoric acid to two tubes for use as blank. Add 0.4 ml of DTCS reagent to all tubes. Incubate the tubes in water bath at 37 degree C for 3 hours. Remove the tubes from the water bath and cool for ten mins in an ice bath. While mixing slowly add to all tubes 2 ml of cold sulphuric acid and mixed in a vortex mixer. Adjust the spectrophotometer with the blank to read zero at 520 nm, and read the calibrators and unknowns. Plot the concentration of each working calibrator versus absorbance values. The calibration curve obeys Beer's law up to an ascorbic acid concentration of 2 mg/dl.

CALCULATION:

From the standard graph the test absorbance will be plotted and the value will be calculated for 100 ml.

REFERENCE RANGE: 34 – 114 μmol/L (5-15 mg/dl).

SAFETY PRECAUTIONS:

- Handle all samples as potentially infectious.
- All reagents are handled with care and avoid contact with eye, skin & mouth.
- Do not use mouth pipetting.
- Discard used reagents and samples as per disposal procedure.

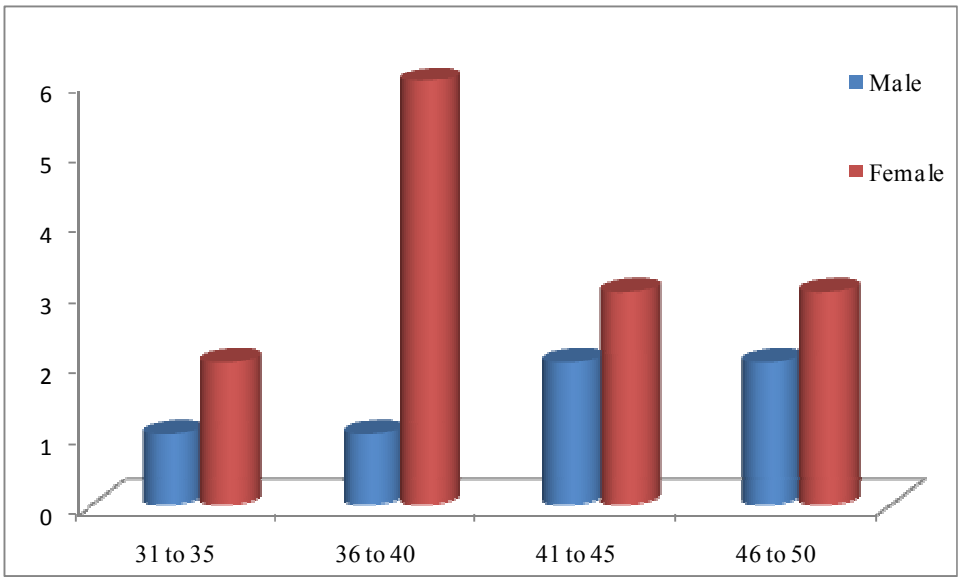
OBSERVATION AND RESULTS

AGE DISTRIBUTION

Table 1.Age distribution of 20 patients

S NO.	AGE	MALE	FEMALE	TOTAL	PERCENTAGE
1	31 to 35 years	1	2	3	15%
2	36 to 40 years	1	6	7	35%
3	41 to 45 years	2	3	5	25%
4	46 to 50 years	2	3	5	25%

Figure 14. Age wise distribution of Males & Females



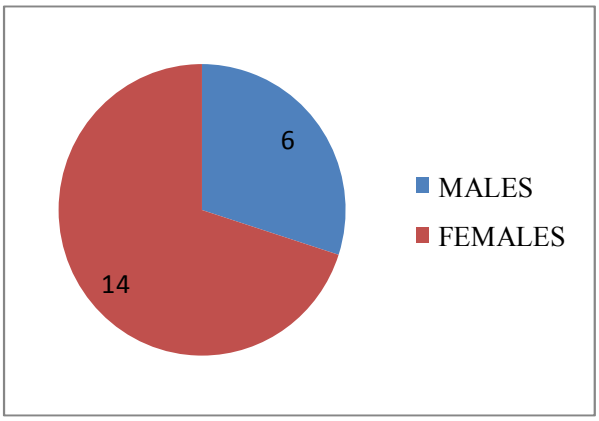
In our study group of 20 people, age group distribution showed 3 patients were in the age group of 31 to 35 years, 7 patients were in the age group of 36 to 40 years, 5 patients each in the age groups of 41 to 45 years & 46 to 50 years. The mean age of patients in our study group is 38.55 years. This shows occurrence of cataract in early age is less (15%) and thereafter increases with age as compared with other studies[13,15,16].

SEX DISTRIBUTION:

Table 2. Distribution between Males and Females

SEX	NO.OF PATIENTS	PERCENTAGE
MALE	6	30%
FEMALE	14	70%
TOTAL	20	100%

Figure 15. Sex wise distribution



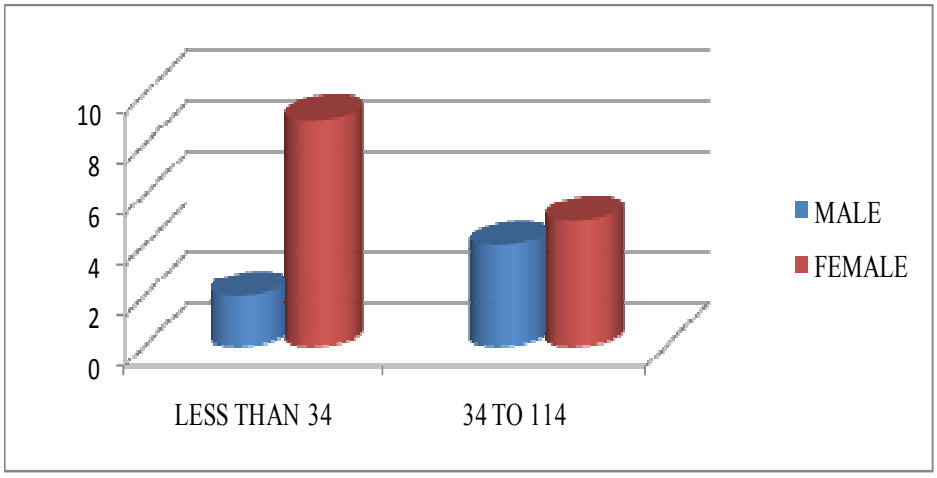
Among 20 peoples of our study, occurrence of cataract is more in females which is 70% in comparison with male which is 30%. 42.85% of female patients were in the age group 36 to 40 years. This shows increased prevalence of cataract in female patients which is similar to Julie A Mares et al study[17] and other studies[15,16,18].

VITAMIN C LEVEL

Table 3. Distribution of Blood Vitamin C level

VITAMIN C LEVEL (µmol/L)	MALE	FEMALE	TOTAL	PERCENTAGE
Less than 34	2	9	11	55%
More than or Equal to 34	4	5	9	45%

Figure 16. Blood Vitamin C Level Wise Distribution



Normal range of Blood Vitamin C level in our study is 34 to 114 µmol/L estimated by Spectrophotometer method. In our study group of 20 patients, 11 patients (55%) had values less than normal and 9 patients (45%) had values in normal range. This shows 55% of the patient had lower levels of Vitamin C as compared with other studies[19,20,21,22.].

Among the 11 patients who had less than the normal Vitamin C level, 9 patients (81%) were females. This was also seen in other studies showing female prevalence of low Vitamin C level[18,22,23.].

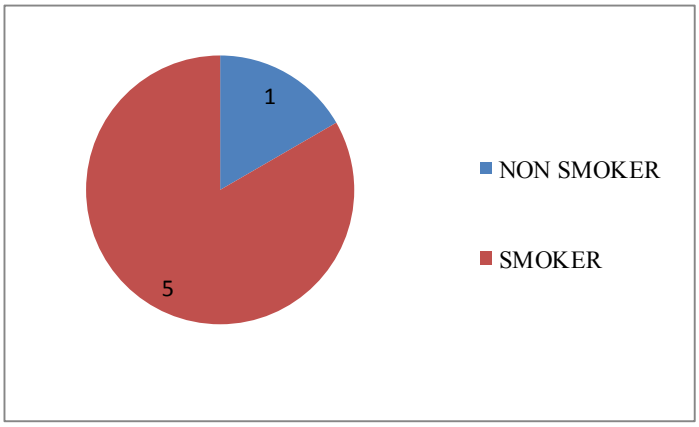
Among 9 patients who had normal Blood Vitamin C levels, 3 patients (2 Male & 1 Female) had Vitamin C level in the lower side of normal range.

SMOKING AND CATARACT

Table 4.Distribution of Smokers and Non-Smokers

SMOKING HABIT	MALE	PERCENTAGE
Smoking	5	83.3%
Non smokers	1	16.7%

Figure 17.Smoking population distribution



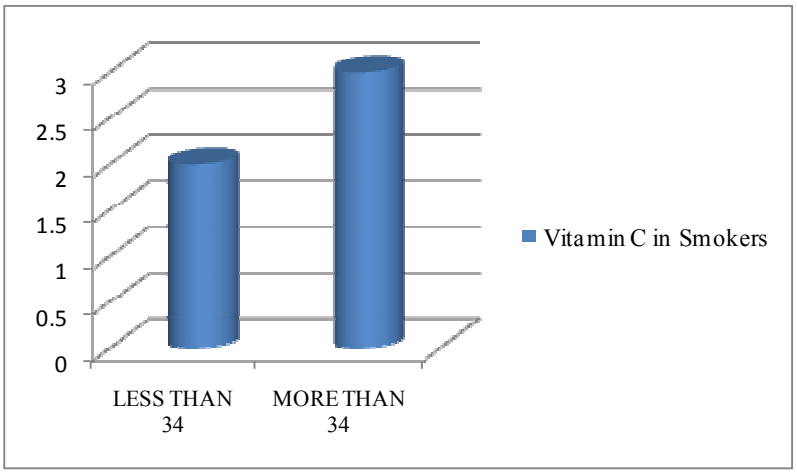
In 6 male patients, 5 of them had the habit of smoking which is 83.3% had cataract. This shows increased risk of cataract development among males who have habit of smoking as shown in other studies[24,25].

VITAMIN C LEVEL IN SMOKERS

Table 5. Distribution of Blood Vitamin C level in Smokers

BLOOD VITAMIN C LEVEL	SMOKERS	PERCENTAGE
<34 µmol/L	2	40%
>34 µmol/L	3	60%

Figure18. Blood Vitamin C Level in Smokers



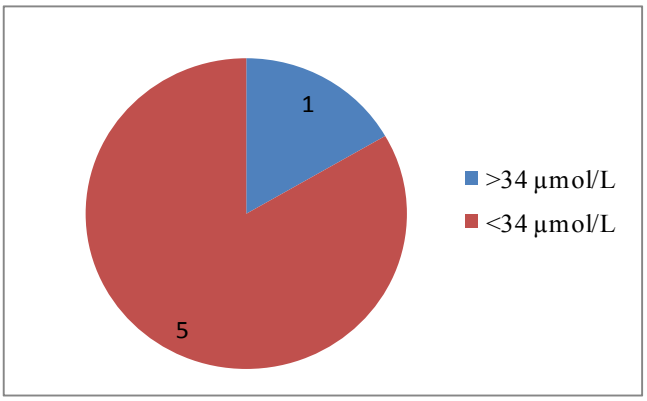
Among our male patients 5 of them had the habit of smoking, Out of five 2 of them (40%) had Vitamin C level less than 34 µmol/L and 3 of them (60%) had more than 34 µmol/L , but 2 among these had Blood Vitamin C level of lower side of the Normal range. Overall the Blood Vitamin C level comparatively lower in smokers than Non-smokers whose Blood Vitamin C level is in higher range. This is similar in other studies[19,22,24].

BIOMASS AND VITAMIN C LEVEL

Table 6. Distribution of Blood Vitamin C level in Biomass Gas Exposure

BLOOD VITAMIN C LEVEL	BIOMASS GAS EXPOSURE		BIOMASS GAS NON EXPOSURE	
	No of Patients	Percentage	No of Patients	Percentage
<34 µmol/L	5	83.3%	4	50%
>34 µmol/L	1	16.7%	4	50%

Figure 19. Vitamin C levels in Smokers



In our study 6 female patients had Biomass gas exposure, out of which 5 patients (83.3%) had low Vitamin C level. Among the 8 non exposure patients Vitamin C level of patients 50% had <34 µmol/L and remaining 50% had >34 µmol/L. This shows low Blood Vitamin C level in Biomass gas exposure patients as found in other studies[19,20,22].

OUTDOOR EXPOSURE AND VITAMIN C LEVEL :

Table 7. Blood Vitamin C levels in Patients with <8 hours of Outdoor exposure

Blood Vitamin C level	No. of patients	Percentage
<34 µmol/L	10	83.3 %
>34 µmol/L	2	16.7 %

Figure 20. < 8 hours of Outdoor Exposure and Vitamin C level

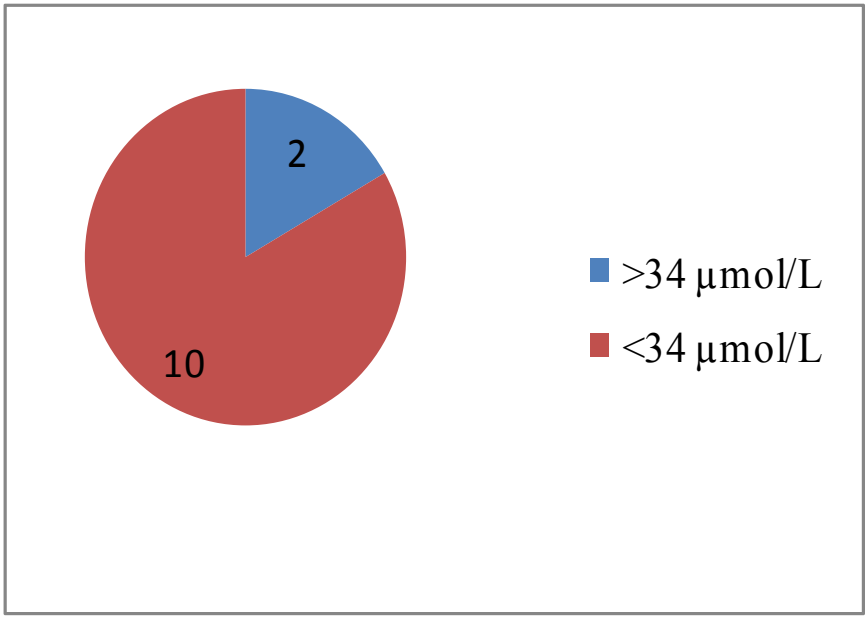
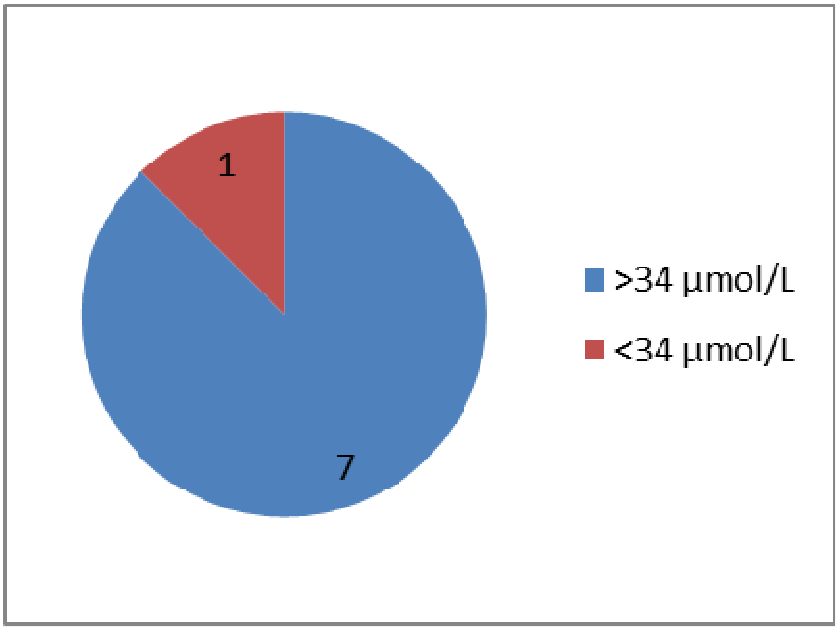


Table 8. Blood Vitamin C levels in Patients with >8 hours of Outdoor exposure

Blood Vitamin C level	No. of patients	Percentage
<34 µmol/L	1	12.50%
>34 µmol/L	7	87.50%

Figure 21. < 8 hours of Outdoor Exposure and Vitamin C level



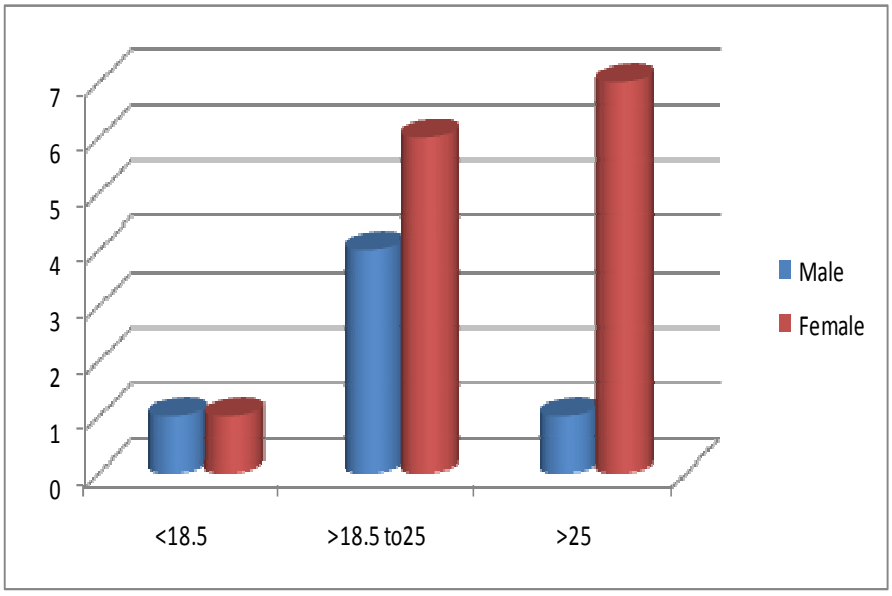
Outdoor Sunlight exposure was found from the patient occupation. In our study group of 20 patients, 12 of them had < 8 hours of exposure, 8 of them had > 8 hours of exposure. Among the 12 who had less exposure, 10 of them (83.3 %) had less Vitamin C level and among those 8 patients who had more exposure, 7 of them had normal Vitamin C levels. In our study, levels of Vitamin C among these patients showed no significant correlation to outdoor exposure as shown in other studies[19,22.] Which showed significance.

BODY MASS INDEX AND VITAMIN C LEVEL :

Table 9. Distribution of Blood Vitamin C level in BMI

BODY MASS INDEX	MALE	FEMALE	TOTAL	VITAMIN C LEVEL µmol/L	
				<34	>34
<18.5	1	1	2	2	-
≥18.5 to25	4	6	10	6	4
>25	1	7	8	3	5

Figure 22. Body Mass Index Distribution



BMI of our study group patients showed, 2 patients were underweight less than 18.5, 10 patients within normal weight > 18.5 to 25 and 8 are above 25 indicating obesity. Patients with less than 18.5 BMI showing low nutrition status correlating with low Vitamin C levels as shown in other studies[17,18,22.].

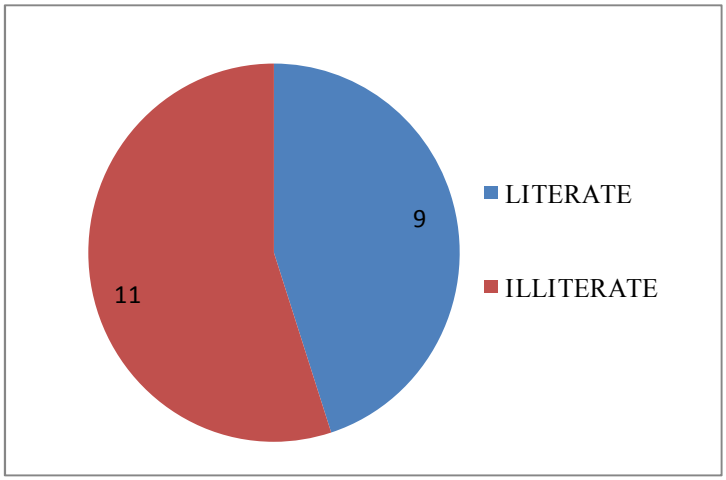
Among the 20 peoples 10 of the (50%) had normal BMI, out of these 10, 6 of them had low Vitamin C level and 4 with normal Vitamin C level. In these 4 patients 2 had lower side of normal range. Among the overweight 8 patients 5 of them had normal Vitamin C level and 3 of them had less Vitamin C level. Obesity itself is a risk factor in development of cataract as shown in other studies[26,27.].

LITERACY AND VTAMIN C LEVEL

Table 10. Distribution of Blood Vitamin C level

LITERACY LEVEL	No.of Patients	VITAMIN C LEVEL µmol/L	
		<34	>34
Literate	11	5	6
Illiterate	9	6	3

Figure 23. Distribution of Literacy level



Among the 11 illiterate patients Vitamin C level was in normal range in 6 of them and less in 5 of them and among 9 literate patients 6 patients had less Vitamin C and 3 patients had normal values. This comparison shows no significant change in Blood Vitamin C levels among the literates and illiterates, But other studies[19,22.] shows that Vitamin C level is low in lower education level.

DISCUSSION

20% of the global burden of blindness with cataract as principle cause is from India. Cataract occurs during senility, but it also occurs in varied age group. Patients in age group in 30 to 50 years who presented with cataract without secondary causes to our tertiary eye care hospital RIOGOH, Egmore, Chennai are taken as study group. All the patients of this study belong to low socio-economic status. Multiple questionnaires are included in case sheet proforma to rule out other secondary causes of cataract and presence of risk factors.

In our study group the mean age of the patient presented with cataract is 38.55 years. 50 % of the patients were above 40 years and 15% of the patients were below 35 years. There is increased incidence of cataract as the age advances which is similar to other studies[13,15,16.].

In our study female preponderance was more (70%) when compared to male (30%). Women in general have increased incidence than men as shown in other studies[15,16,18.].

In our study group 55% of patients of the patients had low Vitamin C level when compared with 45% who had normal Vitamin C range. Among the patients who had normal Vitamin C range, 3 of them had Vitamin C values in the lower side of normal range. This shows Vitamin C level is less in 55% our study group. Vitamin C level has inverse association with aged cataract which is shown in other studies[19,20,21,22.]. Our study group of people who had cataract without any secondary cause has low levels of Vitamin C.

These levels which are seen as percentage difference, we could not significantly prove by statistical method because of less number of subjects involved in the study and wide normal range of Blood Vitamin C level.

Among male patients presented in the study 83.33% are smokers. This shows there is increased risk of cataract in men who have the habit of smoking which is similar to other studies[24,25.]

Vitamin C level among these male non-smokers was normal. While in those who had habit of smoking, 40% had low Blood Vitamin C levels and 60% had normal values, but 2 of the had lower range of normal values. This shows there is a risk of low levels of Vitamin C in smokers as shown in other studies[19,22,24.].

Biomass fuel usage in our study group is 6 patients, Out of which 83.3% had low levels of Vitamin C. This shows Biomass fuel exposure is associated with low Vitamin C level as found in other studies[19,20,22.]

In our study group 12 (60%) of them had less than 8 hours of exposure and 8 (40%) of them had greater than 8 hours of exposure. Among the 12 patients 10 of them had less Blood Vitamin C levels and among those 8, 7 of them had normal Vitamin C levels. In our study Blood Vitamin C level has no significant relation to outdoor exposure as shown in other studies[19,22] which showed significance.

Body mass Index shows the nutrition level of the patients. In our study 10% of the patients were underweight whose Vitamin C level is less. This was also seen in other similar studies[17,18,22.].

Low level of Vitamin C is also seen in the group who had normal Body mass index. This shows that low level of Vitamin C is a probable risk factor in developing cataract. Among 40% obese patients who had more

BMI, Blood Vitamin C levels are normal but high Body Mass Index by itself is a risk for developing cataract as shown in other studies[19,22,26,27].

In our study group literacy status has no relationship with Blood Vitamin C level but in other studies[19,22] it has been shown to have inverse relationship.

CONCLUSION

Cataract in middle age group of people causes a socio-economic burden because this is a disease of senility. Many multi variant risk factors influence the development of cataract other than secondary causes of cataract. Many large scale studies shows the role of Antioxidants in prevention of cataract. Of these Antioxidants Vitamin C has a major role in prevention of cataract as it is not synthesized in lens and depends upon dietary sources.

Our study is comparable with other studies which show the prevalence of cataract is more common among females. Vitamin C level is low in 55% of patients in our study group. Smoking and Biomass exposure has inverse association with Blood Vitamin C levels and Low BMI shows low level of Vitamin C. All these factors are seen to positively correlate with other studies in the same field.

The main drawback of our study is that all the data shows relatively high percentage when compared with others but it is not proven to be statistically significant because in our study group sample size is very less and normal range of Blood Vitamin C are very wide (34 to 114 μmol/L). Moreover, there are multiple risk factors for cataractogenesis which are inter-related to each other.

FUTURE SCOPE

Our study has shown Vitamin C level is comparatively low in middle age group of people having cataract and various risk factor like smoking, Biomass fuel exposure, Nutritional status affecting its level. However these results could not be proven as statistically significant.

If this study has been conducted involving large number of subjects we may get statistically significant data which might be helpful in prevention from development of cataract by supplementation of antioxidants especially Vitamin C through diet or medications.

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APPENDIX - I

INFORMATION SHEET

- We are conducting "A CLINICAL STUDY ON CORRELATION OF BLOOD VITAMIN C LEVEL WITH CATARACT IN MIDDLE AGED PEOPLE "among patients attending Regional Institute of Ophthalmology and Government Ophthalmic Hospital Egmore, Chennai.

- The purpose of this study is to evaluate the association of Blood Vitamin C level and other risk factors in the development of middle aged cataract.

- We are selecting patients in the age group of 30-50 years who has bilateral cataract and unilateral cataract with other eye pseudophakia or aphakia or lens changes or normal lens.

- In this study we are undergoing estimation of Blood Vitamin C level and evaluating clinical history including personal h/o, occupational h/o, general examination with anthropometry measurement

- The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

- Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.

- The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of investigator Signature of participant

Date:

APPENDIX - II

PATIENT CONSENT FORM

Name : Date :

Age : Sex :

I have been explained clearly about the research and its objectives. I understand the facts and I give full consent to be included as a participant in the "CLINICAL STUDY ON CORRELATION OF BLOOD VITAMIN C LEVEL WITH CATARACT IN MIDDLE AGED PEOPLE."

- ❖ I have been explained about the nature of the study, Blood investigations and history evaluation requirements for this study.
- ❖ I have been explained about my rights and responsibilities by the investigator.
- ❖ I hereby give permission to the investigators to release the information obtained from me as result of participation in this study to the sponsors, regulatory authorities, Govt. agencies, and IEC.
- ❖ I understand that they are publicly presented.
- ❖ I have understood that my identity will be kept confidential if my data are publicly presented.

- I have my questions being answered to my satisfaction.

- I am aware that if I have any question during this study, I should contact the investigator. By signing this consent form I attest that the information given in this document has been clearly explained to me and understood by me, I will be given a copy of this consent document.

Date Signature

APPENDIX - III

CASE SHEET PROFORMA

TITLE: "A clinical study on correlation of Blood Vitamin C level with cataract in middle aged people."

NAME:

AGE:

(Identity certificate having DOB / Educational certificate / Marital status & family history / Appearance)

SEX:

DATE:

OP/IP NO.:

ADDRESS:

CONTACT NO:

UNIT:

DIAGNOSIS:

DOA:

DOS & TYPE:

DOD:

CLINICAL HISTORY

C/O:

History of presenting Illness:

a. H/O Defective vision in one/both eyes for past

b. H/O Diminution of vision in one/both eyes

-painless progressive in nature

-painful progressive in nature

-painful sudden loss of vision

-painless sudden loss of vision

c. H/O associated eye pain,redness,coloured halos

d. H/O wearing glasses in past

(if so ? refractive status)

e. H/O any previous ocular surgeries:

f. H/O any ocular trauma

mechanical-

irradiation-

electrical shock-

g. H/O Diabetes mellitus

h. H/O any systemic disease like myotonic

dystrophy,hypocalcemia,atopic dermatitis

i. H/O drug intake

(steroids,miotics, amiodarone, chlorpromazine,others)

j. H/O any multiVitamin intake:

k. H/O antenatal/post natal ward:

l. Family h/o cataract presented in early age:

PAST HISTORY:

Any past H/O TB, Asthma,HT, Arthritis,IHD

PERSONAL H/O:

a.Diet:

b.H/O tobacco use(smoking beedi/cigarette)

c.H/O alcohol intake(frequency/type)

d.occupational H/O: Recent:

past:

e.Amount of outdoor exposure to sunlight:

f.Education:

g.Marital status:

h.Status of living:

Economic status-

Quality of house/room: own / rental

Household cooking fuel: kerosene, electricity, LPG, biomass.

GENERAL EXAMINATION:

Height:

Weight:

BMI:

Nutritional status:

Underweight: < 18.5

Normal weight: ≥ 18.5 to < 25

Overweight and obese: ≥ 25

BP:

RBS:

Anaemic:

Musculoskeletal system:

Skin:

CNS:

CVS:

RS: Abdomen:

OCULAR EXAMINATION:

RE LE

1. Visual acuity
2. EOM
3. Lids
4. Conjunctiva
5. Cornea
6. Iris
7. Pupil
8. Anterior chamber
9. Lens
10. IOP
11. Duct
12. Refractive status
13. Fundus examination

    Media -

    Disc, vessels & macula –

14. A scan
15. Keratometry
16. IOL power
17. B scan

(For those cases in which fundus examination is not possible)

INVESTIGATIONS:

For Blood Vitamin C level:

Date and time of sample collection:

Results:

Normal value:

Comparison result:

Methodology of Vitamin C estimation:

Spectrophotometer method :

Follow up procedure:

Date of cataract surgery:

Post-operative period:

Post-operative RR status:

SUMMARY:

KEY TO MASTER CHART

S. No	-	Serial Number
ODE	-	Out Door Exposure
M	-	Male
F	-	Female
>	-	Greater than
<	-	Less than
+	-	Present
-	-	Absent
BMI	-	Body Mass Index
BMG Exp	-	Biomass Gas Exposure
VIT C LEVEL	-	Blood Vitamin C Level

MASTER CHART

S.NO	NAME	AGE (Years)	SEX	ODE (In Hours)	LITERACY	BMI	SMOKING / ALCOHOLIC	BMG Exp	VIT C LEVEL (µmol/L)
1	Ramalingam	31	M	>8	+	25.83	--	--	77.2
2	Vijaya	34	F	<8	--	19.46	--	+	29.1
3	Rani	35	F	<8	--	23.58	--	+	4.8
4	Gopi	36	M	>8	--	23.40	+	--	38.4
5	Kumudha	36	F	>8	--	18.8	--	+	16.9
6	Shoba	37	F	<8	+	25.39	--	--	9.36
7	Kalaiselvi	37	F	>8	+	32.38	--	+	88
8	Selvi	37	F	<8	+	30.48	--	+	26.9
9	P.Lakshmi	38	F	<8	--	27.42	--	--	79.4
10	Komala	40	F	>8	--	20.16	--	--	86.3
11	Jayanthi	41	F	<8	+	25.54	--	--	22.1
12	Chitra	42	F	<8	--	18.66	--	+	10.2
13	Sivakumar	44	M	<8	+	21.06	+	--	24.30
14	Lalitha	45	F	<8	+	19.8	--	--	23.8
15	Elumalai	45	M	>8	+	19.72	+	--	86.8
16	Kala	46	F	<8	--	27.2	--	--	94.2
17	Poosum	47	F	>8	--	28.88	--	--	49.1
18	Kannan	48	M	>8	--	19.14	+	--	41.7
19	Settu	48	M	<8	--	16.72	+	--	10.2
20	E.Lakshmi	49	F	<8	+	16.42	--	--	33.6